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ABSTRACT

A clinical psychologist describes an approach she uses to assess learning disabled students. She explains that brain function is analyzed through a sequence of tasks charting visual and auditory discrimination, perception, memory, organization, integration, and output. An example is cited in which an 11 year old child with traumatic brain injury was found to have severe visual organization and integration difficulties, and was placed in a program stressing tactile and auditory input channels to teach reading, spelling, and arithmetic. A 16 year old with an auditory learning disability is said to have blossomed through the use of correspondence and taped lessons and tutoring. (CL)

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THE ANALYSIS OF BRAIN FUNCTION - A NEW APPROACH
TO THE ASSESSMENT OF CHILDREN WITH LEARNING DISORDERS

Geraldine Schwartz, Ph.D.

Paper presented at
the Annual Meeting of
the International Council of Psychologists
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THE ANALYSIS OF BRAIN FUNCTION - A NEW APPROACH
TO THE ASSESSMENT OF CHILDREN WITH LEARNING DISORDERS

by
Geraldine Schwartz, Ph.D.

The movement to test intelligence has been in the mainstream of the development of the science of psychology since Binet first developed a quantifiable measure of intelligence based on the number of age appropriate tasks a child could do. The child's mental age was determined by the extent to which he was able to compete with his age mates in doing these tasks. Those whose performance was well below their peers were considered mentally retarded and a complete set of perceptions, theories, and later even institutions developed everywhere in the civilized world to deal with people who fell into this category. The movement gathered momentum with the advent of the Wechsler Tests and their translation and wide spread use in many countries of the world as the seminal measure of intelligence. In fact, even as other tests were developed, the Wechsler Tests were used as the model against which tests of all kinds were normed and standardized. When the concept of intelligence quotient was added to Binet's concept of mental age to produce the idea of intelligence quotient, and when the notion of I.Q. was incorporated by Wechsler, it became an universal way of describing human intelligence both in lay and scientific terms. All this on a test like the WISC-1, which, may I remind you, was standardized on a representative sample of 200 American children of each of 11 age groups from 6.0 to 16.11 years for a total of 2,200 cases.

Intelligence tests have made an enormous contribution to our understanding of human intelligence. Because of their recognized excellence, they are in current widespread and regular use in schools, hospitals and clinics throughout the world. Most unfortunately, they are also being misused to answer questions for which they were not really intended or designed. This misuse has had a particularly detrimental affect on children whose learning disorders, brain injury or other handicapping conditions have interfered with successful age appropriate performance on these tasks. The effects of a low I.Q. score, and the consequent label as mentally deficient, affects the life of a child and his future in the most profound ways. His teachers and parents reduce their expectations of him and his own subsequent self-concept produces a predictable self-fulfilling prophecy. His intellectual status is communicated to him often in very subtle ways. It is incorporated into his belief system and is reflected both in his behaviour and the behaviour of others in his social and educational environment toward him. He is taught less, challenged less, involved less and he learns less than his peers. As they move ahead and learn to read and write, and as they acquire the information which will form the basis of their successful performance on intellectual tasks, including tasks on I.Q. tests, he falls further and further behind. Every day he is under the sentence of that label is a further step in the direction of his eventual failure and dependence on society.

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During the past 4 years in my work as a clinical psychologist, and director of a clinic for children with learning disabilities, I have been confronted on a daily basis with the disastrous effects of misdiagnosis on children, and with the pressing need to develop new ways to assess potential learning performance in children whose learning disorders or brain injury have prevented smooth development in the public education systems in North America, with the consequent delay in developing the crucial skills of reading, writing, spelling and doing arithmetic at the same rate as their peers. This new assessment would have 2 major benefits:

1. It would do away with the label that come from poor performance on I.Q. tests.
2. It would define for the child's educators where precisely the difficulty was, and most importantly what they could do about it.

Last summer after a most successful I.C.P. conference in Bergen, Norway, I attended a conference in Belgium, at the University of Louvain and heard Karl Pribram describe brain function in a different way. You will have to pardon the looseness with which I describe this idea, but I understood Karl to suggest that sending a signal to the brain was like throwing a pebble into a stream. It created a kind of splash or neurological activity in the receiving area and sent out a series of electrochemical ripples through the brain which resulted in the output we call performance. This idea festered all summer and in the fall when I had the task of working with a number of brain injured children, I tried out the following new procedures which I have called the Analysis of Brain Function. I share these procedures with you at this early stage because the results have been extraordinary, and those of you in the audience who are clinicians know the urgency of the problem and will perhaps share my excitement at the promise of this procedure. Some of you may even be interested in trying some pilot research cross-culturally with me as I begin to organize to do more orderly research.

It is important to say at the outset that I have not invented a new test, but merely organized existing tasks, tests and subtests in a new way. It is this organization and the interpretation of performance which allows for the development of teaching prescriptions to maximize a child's potential to learn - even a brain injured or learning disabled child.

There are 2 major input channels to the brain used by our education system to deliver curricula; the visual channel and the auditory channel. Considering Pribram's pebble analogy, if we could watch the trajectory of the pebble as the brain processes information, through the visual channel for example, we would want to know whether the signal is clearly seen (vision), whether it can be discriminated from other signals (visual discrimination), how it is perceived (visual perception), remembered

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(visual memory), organized (visual organization), integrated (visual integration), and whether the resulting performance (output) is accurate. If there is a problem somewhere along the channel, we would be able to identify where it is, and to predict what kind of educational problems it will produce. We would also find out, if we looked similarly along the auditory channel, whether one of the input channels was clear, and could be used as an alternate pathway for teaching. We can then compare the child's performance on those tasks with age norms to determine whether he is progressing at the same rate, or at a slower or faster rate than his peers. This would allow the development of a teaching prescription which would:

1. Make use of the child's strengths.
2. Develop the weak areas to the extent possible.

It is also important, of course, that the tasks chosen to do this job are stripped of the requirements of accumulated knowledge, information and skill, such as reading and writing and thus allows the observation of the child's performance on tasks which indicate how he discriminates, perceives, remembers, organizes and integrates visual and auditory signals to the brain.

Examples of how this is done can be seen in the following slides.

1. Read this - Slide presentation from MVPT, Hooper, Beery, etc.1
STOP
2. STOP
POTS
TOPS
SPOT
3. from MVPT

a) 1. Visual Discrimination.	Item 1
b) 2. Visual Perception.	Item 5, example 9-13
c) 3. Visual Memory.	16a, 16b
d) 4. Visual Closure.	Item 24, 28
8. from Hooper 16,17,18, 19,20,21
3 slides Visual Organization.
9. from Beery 10,13,17,19
3 designs.

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In the same way, auditory tasks are used to determine whether the child discriminates between similar auditory signals, remembers, organizes and integrates through the auditory channel.

Once brain function is analyzed, a battery of academic tasks in reading, spelling and arithmetic are administered to verify the effect of brain function problems on the child's classroom performance. Visual channel problems will result in poor reading strategies. The eye will not sweep efficiently across the line of print and down to the next line. The child will lose his place, leave off the ends of words, skip words, guess and add words that are not there and will be generally slow and bumbling in the whole process. Problems in visual organization, closure and memory will result in poor spelling ability, reversal of words and letters, etc. Poor auditory organization and auditory memory will result in difficulty in listening tasks and comprehension, etc. Each area of problem will result in consequent difficulties with the academic tasks. The results may then be analyzed and a prescription designed that will maximize the child's potential to learn. Two examples of such analysis and the results after 8 months of treatment will be used for illustrative purposes in this paper.

1. Michael aged 11 years.

Michael was injured in a car accident when he was 7 years old. Massive injury at the back of the head, particularly in the occipital regions, produced almost vegetative behaviour. After a recovery period in which he had to learn to walk and talk again, he returned to school. Although he had previously learned to read and write, and was performing as an average student, he needed to learn all these tasks again from the beginning. After the second year in school he was approximately at the Grade 1 level again and he stayed there for the next 3 years. Promoted because of size and age to higher grades, he worked on an individualized programme of primary work and appeared to make little progress. Consequent behaviour problems were destructive and reflected his frustration and anger. He refused to go to school; when he did go he was aggressive, acting out and getting into trouble. Returning home from an hour on the bus in which he endured the taunts of his classmates, he came into the house and blew, throwing a tantrum, breaking everything he could, throwing the contents of the refrigerator on the floor and then jumping on his bike and riding pell mell down the highway in front of his home. When he threatened to burn down the barn and strangled the cat with his bare hands, it was determined that either something drastic would have to be done or he would have to be institutionalized and restrained for his own protection.

Brain function analysis revealed significant visual channel problems congruent with his area of injury. He could see and discriminate and remember simple forms, but had great difficulty with visual organization tasks, where he was asked to manipulate 2 dimensional objects in space and

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indicate the resulting whole figure, visual closure where he would have to complete the object when only part was available, and visual integration. Copying a complex design was very difficult and the result was distorted and reversed, out of proportion etc. Thus, simple Grade 1 texts could be deciphered but as the prose became more visually complex, as the page contained more words, as the words became longer and multisyllabic, Michael was lost. It is interesting, however, that he could learn whatever he could hear. Vocabulary was well developed, he could express himself well and understand complex oral directions. He answered the comprehension questions on texts read to him at age appropriate levels. In spite of this, poor self-image, short attention span, entrenched avoidance strategies to academic tasks, and inappropriate social and behaviour strategies interfered with school performance in every area of Michael's endeavours. He was angry, frustrated and he and everyone else were about to give up.

A new programme was designed for Michael to use both the tactile and auditory input channels to teach reading, spelling and arithmetic. He learned to spell using a multi-sensory screen and a wax crayon which produced his words in a Braille-type script of raised bumps. Talking books and a taped arithmetic and reading programme, commercially available, were used. A tutor was trained to convert visual input first to aural and then back to visual signals. She worked with Michael for 3 hours a day from 2 - 5 o'clock, extending his school day from 5 to 7 hours, teaching him the Grade 4 programme a week ahead to mastery through the multi-sensory channels. During the rest of the time he attended a regular Grade 4 class with 21 other children. This table indicates Michael's progress between October 1980 and June 1981.

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TABLE 1.

Michael (B.D. 13th June 1969)

<u>Test</u>	<u>Oct. 1980</u>	<u>June 1981</u>	<u>Growth</u>
1. Ammons Q.T. (Receptive Language)	9.3 years	10.6 years	1.3 years
2. D.S.T. (Spelling)	1.7 grades	3.8 grades	2.1 grades
3. Silvaroli-Classroom Reading Inventory			
<u>Sight Words</u>			
Grade 1	75% accuracy	100% acc.	-
Grade 2	75% accuracy	95% acc.	-
Grade 3	(wouldn't attempt)	75% acc.	-
Grade 4	-	70% acc.	2 grades
<u>Oral Reading</u>			
Grade 1	Inst. level	-	-
Grade 2	(wouldn't attempt)	Indep.lev.	-
Grade 3	-	Inst. lev.	-
Grade 4	-	(read to him)	2 grades
<u>Comprehension</u>			
Grade 1	90% acc.	-	-
Grade 2	(read to him) 40% acc.	100% acc.	-
Grade 3	-	80% acc.	-
Grade 4	-	(read to him) 70% acc.	2+ grades

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NOTE: In October when the Grade 2 passage was read to him, he scored at 40% accuracy. In June, he reads the Grade 2 and 3 passages himself; when the Grade 4 passage is read to him he scores at 70% accuracy. This is a most significant improvement and reflects the growth in listening comprehension largely due to his training as an auditory learner.

It can be seen that Michael has learned to do basic school tasks at a rapidly accelerated rate. He has been promoted to Grade 5. He will continue to have 3 hours of additional daily instruction probably for the first semester. This will then be reduced gradually until it is only 1 hour each day. Because of his injury, it is likely he will continue to need individualized help at least until high school, when the education delivery system becomes much more aural, teachers talk and lecture for a greater proportion of the time, and by that time he will have learned to simplify visual tasks and to convert them himself for oral channel learning. Since Michael's overall intelligence appears generally average, he should be able to have a reasonably successful school career depending of course on his interest and motivation. Needless to say, Michael's behavioural difficulties have largely disappeared. His teachers, parents and child care workers tell us that he is a different boy, and that the change is miraculous. His previous school principal would not believe he could actually do Grade 4 work nor could the psychologist who had administered the standardized psychologist tests, but the "proof was in the pudding" when Michael scored 92% on a fractions test which he did along with the rest of his Grade 4 class. This is a new skill taught in Grade 4. The results are certainly not miraculous. They are the combined result of the hard work put in by Michael, his teachers and his tutors, and an educational prescription based on the use of alternate open channels to the brain; in this case the auditory channel. It is interesting to note that this is a perfectly good channel for teaching but not one regularly used currently in North American schools. Delivery of education especially in the primary grades to classes of 30 plus children, asks them to look at the board, the stencil in front of them, their books, etc. 80% of early education is delivered through the visual channel. However, this is a recent phenomenon in human history. Previously we passed on information through the oral tradition. The wisdom of the previous generations was passed on by word of mouth. The human brain is thus very receptive to aural learning and when education is redesigned to come through that channel, it can be learned at a child's natural potential rate in spite of a learning disorder centered in the other channel.

Paula aged 16 years.

Conversely, Paula, a 16 year old girl, whose learning disability was centered in the auditory channel, could learn just about anything presented through the visual channel. Injured 4 years earlier in the temporal region, she had to learn to talk, read, write and spell all over again. Her
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auditory channel function was severely impaired. In spite of her efforts and those of her teachers, she appeared not to be able to learn or remember anything at all past the Grade 6 level when she was injured. She was promoted socially, despite her continued failure and finally dropped out of school and out of life. She became depressed, obese and suicidal. She slept 14 hours a day and watched the "soaps" and ate the rest of the time. Analysis of brain function revealed that she could not process auditory information efficiently. Listening skills were consequently very poor. She would sit in the high school class room in Social Studies and be lost after the third sentence. Completely discouraged, she would not bother to read the text. It was interesting to discover, however, that if she could read it, she could learn it. Paula was put on a correspondence programme prepared for children in B.C.'s remote regions. She was immediately more successful. This was combined with intensive tutoring to develop reading comprehension skills, and the use of taped lessons to teach listening skills on simple materials. Pauls is now preparing to return to school next September where she will take a programme in commercial skills, typing, shorthand, bookkeeping, etc. She will also continue her correspondence programme in English, Social Studies, etc. While the loss of 4 years of school is difficult to recover, I am optimistic that Paula can learn to be an independent person, that she will learn marketable skills over the next 3 years in keeping with her overall average level of intelligence.

DISCUSSION:

These two cases are meant to be illustrative. I am beginning to gather together the data of more than 40 successful children treated this year to demonstrate more conclusively that this method shows much promise and needs to be explored both clinically and in applied research models.

New technology and theoretical models are appearing on the scene to make this very important.

A new machine, the Positron Emission Tomographer (PET) is now starting to be put into clinical use on an experimental basis. 7 centres in North America are currently developing this technology. This machine will allow us to take pictures of the living brain for the first time, where now our most sophisticated CAT Scanner does not distinguish between live and dead tissue. This will allow us to send signals to the alert brain, and observe and analyze the electrochemical processing of this information. It will be as revolutionary to neuroscience as the electron microscope was to genetics. Once it comes into more regular use, much soft ware for both research and clinical purposes will be required from psychology.

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Theoretically, new bits and pieces of research are starting to suggest that even though the brain is affected through injury or disease, some regenerative function may still be possible. If this is so, we must learn to map brain function much more precisely than we do now. We are thus on the right road when we explore the effects of using multi-sensory and alternate channel teaching methods in children with learning disorders.

Finally, it is a field between medicine and education where psychologists, with a foot in both disciplines, should firmly take the lead. We may be at the beginning of a new era in using the results of science and technology to clinically benefit human learning dysfunction. How exciting that this beginning should occur in the International Year of the Disabled.